Viability of Sperm in Two Land Snails, *Achatina fulica* Bowdich and *Macrochlamys indica* Godwin-Austen

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INTRODUCTION

ONE OF THE MOST IMPORTANT aspects of the reproduction and maintenance of a population level in terrestrial snails is the viability of sperms. The sperms received in copulation are stored temporarily in the storage organ of the snails. Information on the survival of sperms in the storage organ has been reported for only a few land snail species, viz.: *Helix aspersa* (TAYLOR, 1900) and *Limicolaria martensiana* (OWINY, 1974). Among aquatic snails, *Viviparus* (ANKEL, 1925), *Crepidula* (COE, 1942), *Lymnaea* (CAIN, 1956) and *Oncomelania* (ROTH, 1960, cited in HYMAN, 1967: 301) are on record. Nothing is known concerning this in *Macrochlamys indica*, but *Achatina fulica* kept in isolation has been reported to lay viable eggs up to 382 days (MEER MOHR, 1949). A series of experiments (RAUT, 1977) established that cross-fertilization is essential for laying eggs in both *A. fulica* and *M. indica*. A number of broods extending over a considerable period is obtained from a single specimen after one mating, though repeated mating is a common phenomenon.

MATERIALS AND METHODS

Twelve pairs of cage-reared snails each of *Achatina fulica* and *Macrochlamys indica* were selected immediately after their first mating since the attainment of sexual maturity. They were marked pairwise as A_1 A_2, B_1 B_2, . . . L_1 L_2, for *A. fulica* and a_1 a_2, b_1 b_2 . . . l_1 l_2 for *M. indica*.

Forty-eight cages, each measuring 50×50×50 cm, were used for the study. The sides and roofs of the cages were covered with 1.0 mm polythene net. All 48 cages were placed on soft, humus-rich soil in a shady place in the Calcutta University campus, Ballygunge, Calcutta, exposed to natural light, temperature, humidity and rainfall. Only 1 mated snail was placed in each cage on March 30, 1975. The snails were kept active throughout the year by spraying with water when required, and a regular food supply was maintained until January 29, 1977, the date of termination of the experiments. The viable period of sperms was calculated from the date of the last brood since mating.

EXPERIMENTAL RESULTS

Of the 24 *Achatina fulica* B_2, D_1, F_1 and L_1 did not lay eggs. A_1, A_2, E_1, G_1, G_2, H_2 and L_2 laid their first brood on April 18, 1975, while the remaining 13 specimens laid eggs at different dates between the 26th and 61st day after mating. Most of the snails deposited 3 broods, while only 3 snails (A_2, G_2 and H_2) laid 5 broods. The last brood was laid by the snail K_2, 341 days after mating. The snails were maintained in a similar environment for a further period of 6 months. Subsequently they were dissected and the spermatheca as well as the talon were examined but no viable sperms were present. The viable period ranges ($N = 20$) from 42 to 341 days with a mean, standard deviation and standard error of 149.2, 87.54 and 19.11 days, respectively.

Out of 24 *Macrochlamys indica*, e_1, g_1 and k_2 did not lay eggs. The first egg laying took place on April 8, 1975 by the snails b_1, b_2, c_2 and k_1, while others laid their first clutch between 12 and 39 days from the date of mating. The last clutch laid by the snails a_2 and l_2 was on July 19, 1976, *i. e.*, 476 days after copulation. Most of the snails laid 6 broods during the period. They were maintained for another 6 months and dissection of spermatheca did not reveal viable sperms. The period of sperm viability ranges ($N = 21$) from 63 to 476 days with a mean, standard deviation and standard error of 279.35, 101.54 and 22.71 days, respectively.

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DISCUSSION

In some pulmonates the spermatozoa are produced in the ovotestis throughout the year and the ovotestis duct remains packed with sperms. Fertilization is dependent on the oogenesis cycle (Chatterjee, 1970; Fretter & Peake, 1975; Raut, 1977).

Wide variations in the viable periods of sperms both in aquatic and land snails have been reported by a number of workers. In general, the period is longer in land forms. In aquatic snails the sperms are active for at least 116 days in *Lymnaea* (Cain, 1956), 150 days in *Viviparus* (Ankel, 1925), 365 days or more in *Crepidula* (Coe, 1942) and 540 days in *Oncomelania* (Roth, 1960, cited in Hyman, 1967: 301). In land snails, the period is 520 days in *Limicolaria* (Owiny, 1974) and 1460 days in *Helix* (Taylor, 1900). Meer Mohr (1949) observed that *Achatina fulica* laid viable eggs as long as 382 days. It appears that the sperms were viable for about 366 to 367 days, since *A. fulica* required 16 to 17 days for the development of fertilized eggs. The gestation period and the time required for fertilization were observed to be 20 and 3 to 4 days, respectively (Raut, 1977).

From the limited information available on the viable period of sperms in prosobranchs, basommatophorans and pulmonates it appears that the period varies with species and within the species. The interspecific variation in sperm viability is probably a specific character, which is supported by the fact that in spite of living in the similar environment, the period differs considerably in *Achatina* and *Macrochlamys*. Intraspecifically such variation is presumably influenced by the habitat, since the viable period of sperms in *A. fulica* was at least 366 - 367 days in Sumatra (Meer Mohr, 1949) and 42 - 341 (average 149.2) days in Calcutta.

The long viable period of sperms in pestiferous snails and their ability to lay a number of broods after one mating make it possible for them to populate a new area with the introduction of a single gravid specimen, and this demands our constant vigilance to prevent further spread of agri-horticultural snail pests.

SUMMARY

1. The maximum viable periods of sperms observed in *Achatina fulica* and *Macrochlamys indica* were 341 and 476 days, respectively. It ranges from 42 to 341 (149.2 ± 87.54) days in *A. fulica* and 63 to 476 (279.35 ± 101.54) days in *M. indica*.
2. The interspecific variation in sperm viability is probably a specific character, whereas intraspecific variation is presumably governed by the bio-physical factors of the habitat.
3. The long viable period of sperms is an additional advantage to the species in permitting it rapidly to populate a new area.

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